

AUFLS DATA Requirements

for North Island Distributors

Transpower New Zealand Limited

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Keeping the energy flowing



TRANSPOWER



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Approval

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DOCUMENT PURPOSE

This document outlines the AUFLS data specification and identifies the data that Distributors are required to submit to the System Operator as part of the AUFLS system.

DEFINITIONS

Term	Definition
AUFLS	automatic under-frequency load shedding
AUFLS feeder	a circuit feeder that is capable of being automatically disconnected as a discrete unit with the AUFLS system
AUFLS relay	a control device capable of measuring system frequency and initiating a trip signal to switchgear (circuit breaker) in compliance with the AUFLS system requirements as stipulated by the System Operator
Distributor	has the meaning given to it by section 5 of Electricity Act 2010 – “a business engaged in distribution”
dt/dt	See RoCoF
RoCoF	rate of change of frequency, also referred to a df/dt
2-block / 4-block	describe the number of blocks of load that are shed at a given frequency which form part of the AUFLS system design,
The Act	Means the Electricity Act 2010
The Code	means the Electricity Industry Participation Code 2010

INTRODUCTION

1. Each North Island Distributor must ensure an automatic under-frequency load shedding (AUFLS) system is installed in accordance with the Code. This is vital for New Zealand as a whole, to avoid North Island blackouts in the event of an unforeseen sudden and significant drop in frequency, and to provide as many consumers as possible with a continuous reliable supply of electricity.
2. The Electricity Authority (Authority) is a Crown entity established to regulate New Zealand's electricity industry and markets. The Authority sets rules for the electricity market in the Electricity Industry Participation Code 2010 (Code).
3. Transpower is a State Owned Enterprise (SOE) appointed as the System Operator by the Electricity Industry Act 2010. The Code sets out the functions and principal performance obligations of the System Operator.
4. Each asset owner, the Distributor in this case, must provide information that either complies with the technical codes or is reasonably requested by the system operator, to assist the System Operator in planning to comply and complying with its principle performance obligations.

BACKGROUND

5. The Electricity Authority and the System Operator formally advised that the focus of the Extended Reserve project has been refined. This decision was announced in the Authority's Market Brief on 15 October 2019.
6. The goal of the project is to achieve a secure transition to a 4-block automatic under-frequency load shedding (AUFLS) scheme in the North Island.
7. The data collection is the first phase of the project reset. The Authority and System Operator need to establish an accurate baseline of the current armed load, as well as the potential configuration under a 4-block system.
8. The System Operator and the Authority are intending to develop an information portal that will make it easier for Distributors to report their AUFLS system configuration and relevant load data for the 2-block scheme, transition and ultimately the 4-block scheme.
9. Together, the Authority and System Operator will work with Distributors to develop the best way to implement a new 4-block AUFLS scheme utilising RoCoF (df/dt). Moving from the current two-block arming arrangement will be a multi-year project.

10. Currently, each Distributor is required to maintain 2-blocks of at least 16% load shedding capability at all times (total of 32% of the pre-event load). The proposed block sizes for the new 4-block AUFLS scheme are 10%, 10%, 6% and 6% with the df/dt on the fourth block.

DATA PURPOSE

11. This document describes the AUFLS data required by the System Operator to:
- a. allow monitoring of block sizes
 - b. perform AUFLS provision analysis
 - c. determine the final df/dt block setting
 - d. plan for the transition to 4 Block operation

QUERIES AND ASSISTANCE

12. For queries and assistance please contact:

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TYPICAL AUFLS NETWORK CONFIGURATION

13. Figure 1 shows a typical network configuration of an AUFLS system.
14. Underpinning the configuration is the AUFLS feeder; a distribution circuit feeder that is capable of being automatically disconnected as part of an AUFLS system
15. An AUFLS feeder can be directly connected to a GXP, a zone substation or some other point below the GXP.
16. A Distributor may control multiple AUFLS feeders from a single frequency sensing relay, provided each AUFLS feeder is capable of being set up with a different set of AUFLS block settings, and provided the relevant requirements of the Code are met.
17. An AUFLS feeder is set to trip at a given AUFLS frequency and is therefore assigned to a single AUFLS block within the scheme.

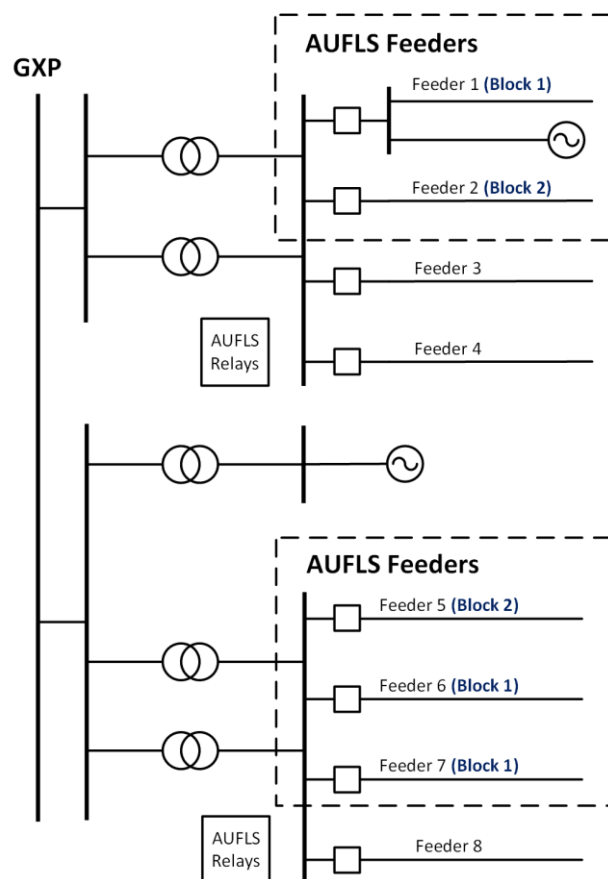


Figure 1 - Typical 2-block AUFLS feeder configuration

DATA REQUIREMENTS

DATA PROVISION

18. The Distributor must provide the specified unit configuration and unit load information for each AUFLS feeder, as well as their total customer and GXP off-take loads.
19. Each Distributor, whether providing AUFLS themselves or not, must provide details of their total customer and GXP off-take loads. The Distributor providing the AUFLS feeder will submit the AUFLS configuration data.
20. Distributors are expected to provide their AUFLS scheme data to the System Operator at least every 12 months in line with their requirements in the Code.

DATA DEFINITIONS

21. The data required is divided into two sets:
 - a. **Data set 1 - Distributors load profiles (time series data)**
 - i. Total Distributor demand - *This shows the Distributor's total demand (MW) for each trading period over 12-months*
 - ii. GXP time series data - *This shows the Distributor's total average off-take (MW) at each GXP for each trading period over 12-months.*
 - iii. AUFLS Feeder time series data - *This shows the Distributor's total average load (MW) at each AUFLS feeder over 12-months*
 - b. **Data set 2 – AUFLS Feeder configuration (snap shot data)**
This shows the location, configuration and status of AUFLS feeders at a given time.
22. In addition to these data sets, it is expected that Distributors will also submit Single Line Diagrams (SLD) showing the AUFLS feeders, relays and circuit breakers.
23. The data definitions are shown in the tables in Appendix A, including the rationale for the data.

APPENDIX A – DATA SETS

DATA SET 1 - DISTRIBUTORS LOAD PROFILE (GXP AND FEEDER TIME SERIES DATA)

24. The following table shows the format of the data:

Serial	Name	Header	Format	Nullable	Description	Example	Rationale
001	Distributor	part_id	Char 4	N	The Electricity Authority participant identifier for the Distributor.	ABCD	<i>To identify the Distributor</i>
002	Total distributor demand	distributor_demand_total	Numeric 3	N	The estimated half hourly total customer demand in MW to the nearest whole number.	560	To be used as a dominator for AUFLS percentage calculation
003	Off-take GXP	gxp	Char 7	N	Valid GXP code.	OLP0556	<i>To identify the GXP off-take and associated feeders</i>
004	Trading period	trading_period_start	yyyy-mm-dd hh:mm TZID	N	The start date and time for each half hour trading period including time zone identifier.	2016-12-25 15:30 NZDT	<i>Identifies the trading period and uses the start only as each trading period is of a fixed length.</i>
005	MW load (off-take)	gxp_mw	Numeric 3	N	The half hourly average load in MW to the nearest whole number. Number can be positive, negative or zero.	123	<i>Show the total off-take for a given trading period and GXP</i>

Serial	Name	Header	Format	Nullable	Description	Example	Rationale
006	Feeder name	aufls_feeder_id	Char 20	N	The unique AUFLS feeder identifier. The name must be same as referenced on the single line diagram showing the feeder	Norfolk St	<i>To identifier the feeder. Coupling the feeder and the provider creates a unique identifier for the load profile</i>
007	Feeder MW load	feeder_mw	Numeric 3	N	The half hourly average AUFLS load at the given feeder at the identified GXP in MW to the nearest whole number. Number can be positive, negative or zero.	123	<i>To show the total load at the AUFLS feeder for a given trading period and feeder.</i>

Notes:

1. To avoid doubt, automatic under-frequency load shedding blocks must not include any interruptible load procured by the system operator
2. Where a Distributor off-takes at multiple GXP they will submit multiple data sets for each GXP (003 and 005).
3. Where a Distributor has more than one AUFLS feeder at a given GXP, they will submit a data set for each (006 and 007)

DATA SET 2 – AUFLS FEEDER CONFIGURATION (SNAP SHOT CONFIGURATION/ATTRIBUTE DATA)

25. The following table shows the format of the data:

Serial	Name	Header	Format	Nullable	Description	Example	Rationale
008	Distributor	part_id	Char 4	N	The Electricity Authority participant identifier for the Distributor.	ABCD	<i>To identify the AUFLS provider</i>
009	Feeder name	aufls_feeder_id	Char 20	N	The unique AUFLS feeder identifier. The name must be same as referenced on the single line diagram showing the feeder	Norfolk St	<i>To identifier the feeder. Coupling the feeder and the provider creates a unique identifier for the AUFLS feeder.</i>
010	Zone substation	zone_substation	Char 20	N	The Zone substation that the AUFLS feeder is supplied from.	Alexander St	<i>To enable reference to SLD.</i>
011	Feeder GXP	gxp_id	Char 7	N	Valid GXP code for the GXP that the AUFLS feeder is supplied from	OLP0556	<i>To provide information for SO to model the AUFLS at GXP</i>
012	SLD reference	sld_ref	Char 20	N	SLD filename/reference name submitted to System Operator by the distributors as part of their Asset Capability Statement	KEN0331SLD	<i>To provide a network topology information for AUFLS percentage calculation and modelling.</i>
013	CB ID	cb_id	Char 5	N	The unique Circuit Breaker ID that trips the AUFLS feeder	CB123	<i>To name the CB for reference to the SLD.</i>
014	CB Type	cb_type	Char 3	N	Type of Circuit Breaker used that CB technology trips the AUFLS feeder e.g. Oil, Vacuum or SF6	VAC	<i>To build breaker opening time statistic for modelling.</i>

Serial	Name	Header	Format	Nullable	Description	Example	Rationale
015	CB opening speed	cb_opening	Numeric 3	N	The minimum, average and maximum circuit breaker opening speeds in ms.	125, 145, 160	<i>To build breaker opening time statistic for modelling.</i>
016	AUFLS relay total operating time	relay_operating	Numeric 3	N	The minimum, average and maximum relay operating speed in ms, including the protection sensing time, 'hold' delay, tripping or auxiliary time.	35, 40, 45	<i>To build relay operating time statistic for modelling.</i>
017	Armed status	currently_armed	True/False	N	Whether the AUFLS feeder is currently armed.	True	<i>To confirm the status of the AUFLS feeder</i>
018	2-block scheme allocation	2_block_alloc	Numeric 1	N	The AUFLS block that the AUFLS feeder is currently allocated to (if any) i.e. the frequency it is set to trip. 0=if it is not allocated. If it is allocated to the 2-block scheme it will be either 1 or 2.	1	<i>To model AUFLS and measure the AUFLS provisioning for the 2-block (current) scheme.</i>
019	4-block scheme allocation	4_block_alloc	Numeric 1	N	The AUFLS block that the AUFLS feeder is currently allocated to (if any) i.e. the frequency it is set to trip. 0=if it is not allocated. If it allocated to the 4-block scheme it will be 1, 2, 3 or 4.	4	<i>To model AUFLS and measure the AUFLS provisioning for the 4-block (new) scheme</i>

Serial	Name	Header	Format	Nullable	Description	Example	Rationale
020	Distribution generation	distributed_gen	Alpha Numeric 20	N	Estimated generation in MW or MVA on the AUFLS feeder. Using actual data or the MVA name plate. 0 if none. This should not include generation upstream of the AUFLS feeder	'250MW' or '250MVA'	<i>To provide information for the calculation of AUFLS percentage</i>
021	Residential load %	residential_load	Numeric 2	N	Estimated percentage (%) of demand that is classified as Residential for the feeder.	25	<i>To improve load model</i>
022	Commercial load %	commercial_load	Numeric 2	N	Estimated percentage (%) of demand that is classified as Commercial for the feeder.	25	<i>To improve load model</i>
023	Light industrial load %	light_industrial_load	Numeric 2	N	Estimated percentage (%) of demand that is classified as Light Commercial for the feeder.	25	<i>To improve load model</i>
024	Heavy industrial load %	heavy_industrial_load	Numeric 2	N	Estimated percentage (%) of demand that is classified as Heavy Industrial for the feeder.	25	<i>To improve load model</i>
025	Comments	comments	Char 256	Y	Distributors may comment on the AUFLS feeder configuration.	The quick brown fox jumped over the moon	<i>To enable distributors, make comment on the data if required</i>

Notes:

4. The 'as at date' for the data is the date the data is submitted.
5. Circuit breaker opening times can be established using historical or test data, or if neither are available, the manufacturer's specifications.